EDITORIAL

Expanded Horizon of Perforator Flap: A Game Changer in Reconstructive Plastic Surgery

Perforator flaps have revolutionized reconstructive Plastic Surgery by enabling the versatile transfer of skin and soft tissue without sacrificing underlying muscle, fascia and nerves significantly reducing donor site morbidity. Modern highly sophisticated techniques like - super thin, ultrathin, & pure skin flaps provide superior reconstructive results and enhance flap precision, safety, and versatility through customization. Amazing imaging tools such as CT angiogram and high-resolution ultrasound allow accurate mapping of perforator anatomy improving flap design and outcomes.

The new definition of perforator is a vessel perforating an envelope of a targeted tissue to be transferred; the superficial fascia for skin, the periosteum for bone, the perineurium for nerve, and the deep fascia for muscle. According to the new definition, all flaps can be precisely classified based on the corresponding "perforator".

Modifications like propeller and deep inferior epigastric artery perforator (DIEP) flaps allow customized often offer superior results compared to traditional, muscle-sacrificing flaps. Challenges like short pedicle length and flap thickness are addressed through perforator-to-perforator super microsurgery, enabling anastomosis of submillimeter vessels with minimal disruption.

Key Aspects of Perforator Flap Advancement

- Reduced Morbidity: By dissecting only the blood vessels (perforators) that supply the skin, the muscle is spared, leading to better functional outcomes.
- Versatility & Techniques: Perforator flaps can be used as local, free, or "propeller" flaps (rotated island flaps) to cover diverse defects.
- Key Applications:
    - Breast Reconstruction- the DIEP flap remains the gold standard, alongside increasing use of local chest wall flaps like internal intercostal artery perforator (ICAP) flap and thoracodorsal artery perforator (TAP/TDAP) flap.
    - Lower Limb- used for complex, superficial, or deep reconstruction by genicular artery flap, ALT (anterolateral thigh), peroneal artery flap.
    - Head, Neck and Torso- ALT, PAP (para-umbilical perforator flap), SGAP/ IGAP (gluteal artery) flaps, superficial circumflex iliac artery perforator (SCIP) flap offer specialized, tissue-specific solutions.
    - Advanced Concepts: "Freestyle" flaps allow for the use of any reliably identified perforator and keystone flap. chimeric flap (combines multiple tissue types e.g., muscle, bone, skin on individual perforators) or polyfoliate flaps enable covering extensive defects by combining multiple tissue types or paddles.
- Sensory Recovery: Studies indicate that even without specific nerve coaptation, perforator flaps can achieve high rates of protective sensation (up to 72% at 1 year).

Historical Perspective:

- Carl Manchot (1889): As a student, Manchot published *Die Hautarterien des menschlichen Körpers* (The Cutaneous Arteries of the Human Body), mapping cutaneous circulation from cadaver studies. He noted vessels emerging between muscles and dividing but did not use the term "perforator".
- Kroll and Rosenfield (1988): These authors were among the first to use the term "perforator flap" in the title of a journal article, "Perforator-Based Flaps for Low Posterior Midline Defects".

- Koshima (1989): I. Koshima and S. Soeda are widely credited with popularizing the concept by publishing on inferior epigastric skin flaps without the rectus abdominis muscle (DIEP flap).
- Hyakusoku (1991): H. Hyakusoku coined the term "propeller flap" to describe a new type of island flap rotated on a cutaneous perforator.
- Super-microsurgery (1998): Koshima continued to advance the field, gaining recognition for techniques allowing the anastomosis of small perforator vessels.
- Blondeel (2006): Dr. Phillip Blondeel, frequently nicknamed "Mr. Perforator Flap," edited the first comprehensive book, *Perforator Flaps: Anatomy, Technique and Clinical Applications*

So, the evolution from anatomical understanding (Manchot) to the use of localized flaps (Kroll), and finally to pedicled (Koshima) and rotated (Hyakusoku) vascularized tissue without sacrificing underlying muscle, has revolutionized modern reconstructive surgery.

The evolution of perforator flaps continues to prioritize minimal morbidity, expanding their role as the "go-to" tool in reconstructive procedures. Advances in imaging, flap elevation techniques, and super microsurgery have enhanced precision, safety, and aesthetic outcomes.

In Bangladesh, Plastic Surgeons are used to reconstruct limb trauma, breast and cancer with various types of perforator flaps. ALT free flap and other lower limb perforator flaps leading the board. Robotic platforms, digital exoscopes, and emerging Artificial intelligence (AI) technologies promise to further improve efficiency, visualization, and surgical ergonomics. AI and augmented reality will revolutionize the automate microsurgical tasks to expand the horizon of Perforator Flap.

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References:

1. Saint-Cyr M, Wong C, Schaverien M, et al. The perforasome theory: vascular anatomy and clinical applications. *Plast Reconstr Surg.* 2009;124:1529-1544.
2. Hong J, Kwon J, Suh H et. al. The evolution of perforator flaps and the future of microsurgery. *JPRAS Open*, 2025;47:33-42
3. Yamamoto T, Yamamoto N, Kageyama T, et al. Definition of perforator flap: what does a "perforator" perforate? *Glob Health Med*. 2019;1(2):114-116. doi:10.35772/ghm.2019.01009
4. Blondeel Ph.N., Van Landuyt K., Hamdi M., Monstrey S.J. Perforator flap terminology: update 2002. *Clin Plastic Surg*. 2003;30:343-346.
5. Taylor G.I. The angiosomes of the body and their supply to perforator flaps. *Clin Plastic Surg.* 2003;30:331-342.
6. Hallock GG. If based on citation volume, perforator flaps have landed mainstream. *Plast Reconstr Surg*. 2012;130:769e-71e.
7. Koshima I., Nanba Y., Tsutsui T., Takahashi Y. Medial plantar perforator flaps with supermicrosurgery. *Clin Plastic Surg.* 2003; 30:447-455.
8. Mardini S., Tsai F.C., Wei F.C. The thigh as model for free style free flaps. *Clin Plastic Surg.* 2003; 30:473-480.
9. Hallock GG. Direct and indirect perforator flaps: The history and the controversy. *Plast Reconstr Surg.* 2003;111:855–865.
10. Pignatti M, Ogawa R, Hallock GG, et al.. The "Tokyo" consensus on propeller flaps. *Plast Reconstr Surg.* 2011;127:716–722.